INTERVENTION SUCCESS STORIES

PRODUCTIVE LAND USE SYSTEMS PROJECT

Prepared by

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of

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EXECUTIVE SUMMARY

This report presents some pictorial and descriptive highlights of Productive Land Use Systems Project accomplishments. Selected land use techniques promoted by the Project are described and estimates of their impacts on farm income are given. The estimates of project impact relate to the 9-month period from the project start date in October 1992 through June 1993.

The major portion of the report presents photographs and descriptions of specific farmer's experiences with the promoted techniques. The land use techniques or "project interventions" featured here are hedgerows, checkdams or "gully-plugs," vegetables gardens, and trees.

Pacot Erzilus and CARE/PLUS extension agent Loreste Moise standing in one of Pacot's fields. The difference in position of the two men indicates the amount of soil build-up behind the leucaena hedgerow running between them.

TABLE OF CONTENTS

EXECUTIVE SUMMARY i

MAP OF HAITI iii

INTRODUCTION 1

HEDGEROW CASE DESCRIPTIONS AND PHOTOGRAPHS 4

CHECKDAM CASE DESCRIPTIONS AND PHOTOGRAPHS 16

VEGETABLE GARDEN CASE DESCRIPTIONS 21

TREE CASE DESCRIPTIONS AND PHOTOGRAPHS 23

APPENDIX A: DERIVATION OF SELECTED FIGURES USED IN THIS REPORT 35

REFERENCES 39

INTRODUCTION

The primary purpose of the Productive Land Use Systems (PLUS) Project is to conserve and enhance Haiti's productive natural resource base by helping farmers to use ecologically sound farming practices that result in higher and more stable income levels for them. PLUS is achieving its purpose by teaching farmers profitable agronomic, horticultural, and agroforestry techniques that provide an attractive return to the farmers' investments in environmentally positive activities. Project personnel have placed their greatest amount of emphasis on soil and water conservation practices.

The purpose of this report is to illustrate, through the following case descriptions and photographs, the types of soil conservation and increased farm income results that are being achieved by the Project. The land-use practices included here represent a selection of the most important techniques being promoted by the Project. These include hedgerows, checkdams or gully-plugs, vegetables gardens, and trees. Before getting into the case descriptions, each of these land-use practices will be described and a brief summary of Project accomplishments relating to each practice will be given. The derivations of estimated values used are described in APPENDIX A.

As will become obvious, the hedgerows and trees pictured or described here were installed by a previous USAID project, Agroforestry II. The PLUS amendment to Agroforestry II changed the basic implementation methods from agroforestry to farming systems. The project was renamed PLUS and implementation began in the Fall of 1992 after a year-long interruption of project implementation activities due to the coup d'etat of September 1991. Thus, the summary figures reported here relate to the 9-month period from October 1992 through June 1993, a period during which nearly one third of the time was devoted to re-establishing field teams and re-orienting the Project to the changed implementation methods called for in the project amendment.

HEDGEROWS

Hedgerows are thickly growing rows of plants planted along hillside contours. The plants in the hedgerow trap eroding soil and reduce rainwater runoff. Fast growing, nitrogen fixing trees are often used to form the hedgerow. Farmers are taught to maintain the hedgerows by trimming the trees at a certain height. The clippings from such trees are used either as a protein-rich forage for farm animals or as a nitrogen-rich soil amendment. As can be seen in the following photographs, the amount of soil trapped by these hillside hedgerows is quite impressive. More important is the impression the hedgerows make on the farmers who will ultimately decide to maintain the hedgerows or not. Not all farmers have been favorably impressed; however, as the case descriptions below indicate, some definitely are. These farmers represent a very

important Project resource through which the benefits of the Project can be expanded.

Since the PLUS Project start date in October 1992 through June 1993, approximately 800 farmers have installed 200 km of hedgerows on their farms. The total farm area protected is about 100 hectares. If 60 percent of these farmers maintain their hedgerows as advised and achieve full benefits from them, we can estimate the present day value of expected increased annual income flows to these farmers at approximately 26,000$US or approximately 54$US per successful farmer. Left unquantified is the value of the hedgerow in allowing farmers to change from a farming system that included several years of fallow to a continuously productive system--a system that tends to conserve hillside resources.

CHECKDAMS

Checkdams or gully-plugs are barriers built across ravines or gullies. When available the gully-plugs are built of rock, otherwise, they are built of wooden posts interwoven with smaller sticks. If possible, the upright posts are cut from selected living trees and will take root, becoming a living barrier. Checkdams are one of the most popular of the Project techniques because the dams quickly fill up with eroded soil creating new farmland. The new land tends to have characteristics (including higher soil moisture) that support high-value crops such as plantain. Thus, the new farmland tends to be more valuable than the surrounding, hillside cropland and certainly more valuable than the ravine from which it was created.

The farmland created behind the checkdams tends to be small in area (20 square meters); so, a lot of effort is required to create an additional hectare of farmland. In spite of this, the easily recognized value appears to excite many farmers. Between late 1992, when the Project began introducing checkdams, and June 30, 1993 some 1200 farmers had constructed 4,467 checkdams. Assuming 20 square meters per checkdam, the total area created is about 9 hectares. Considering the high value of the crops produced, the present value of possible net revenue is about 15,000$US per hectare. Thus, the 9 hectares created have a combined total present value of 135,000 $US or about 112$US per farmer.

Left undefined is the environmental value of the resulting plants and soil cover and the reduction in the amount of soil flowing into streams. Using estimates from checkdams visited in the course of collecting the information for the cases in this report, we can estimate the volume of soil trapped behind the average checkdam at 15 cubic meters. This implies a total estimate of 67,000 cubic meters of soil held behind the 4,467 checkdams completed through June 30, 1993.

VEGETABLE GARDENS

Vegetable gardens, as is the case with gully-plugs, are new land-use practices for most Haitian farmers. Also, as with the gully-plugs, vegetable gardens tend to be small but valuable. Our preliminary observations indicate the average garden is less than 50 square meters but produce net revenue at the rate of about 4,000 - 5,000$US per hectare. Over 1,200 vegetable gardens have been established between the Project re-start date and June 30, 1993. Using assumptions similar to those used in calculating the value of farmland created behind checkdams, we estimate the value of land used for vegetable gardening as being approximately equal to that created behind checkdams. Thus, the total estimated amount of vegetable gardens (6 hectares) has a present value to farmers of about 96,000$US or about 80$US per farmer.

TREES

Most of the trees in the accompanying photographs are older than the PLUS Project and therefore had to be planted by previous projects. The pictures have been included here to illustrate how Project trees will quite likely be utilized. A major difference between the PLUS Project and its precursors is that planting efforts are increasingly being directed toward fruit trees than pole and lumber trees. Thus, trees currently being planted tend to have a higher value to the farmer than the pole and lumber trees previously planted.

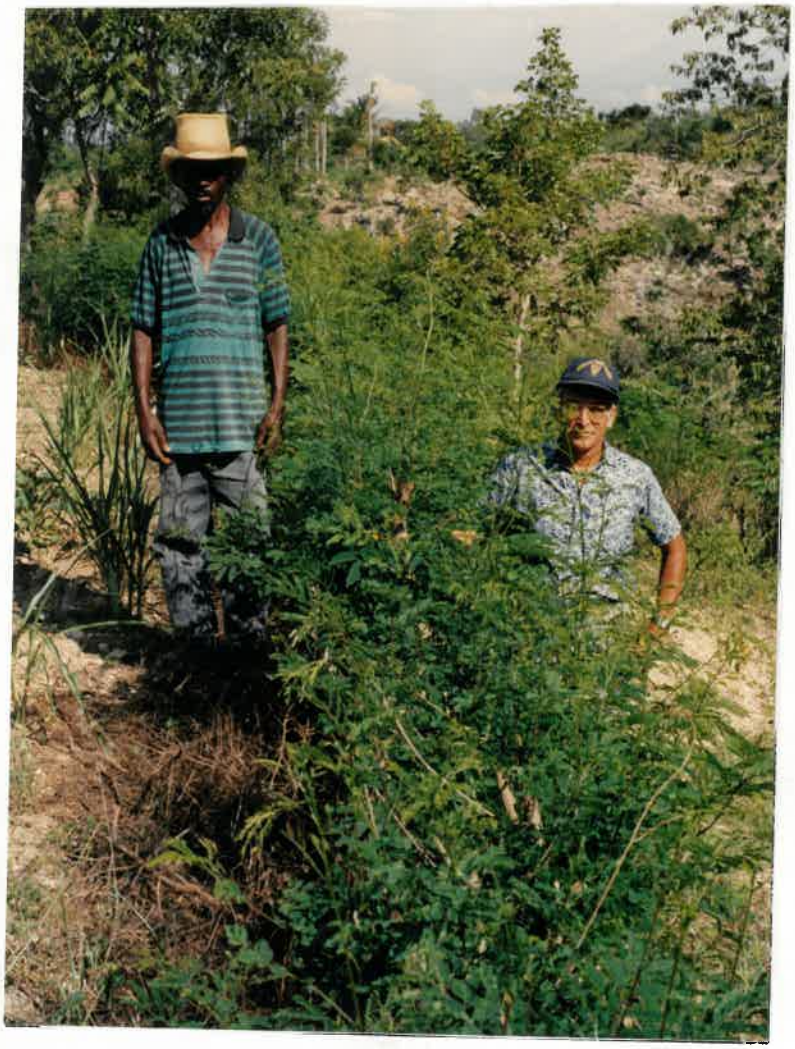
Because the start date of the PLUS Project missed the fall planting season, very few trees were planted until the Spring of 1993. Through June, 68,000 trees had been planted. Of this number, about 8,000 were high-value fruit trees each having an estimated present value to farmers of approximately 10$US. Thus, the value to farmers of fruit trees planted is approximately 80,000$US. The hardwood species have a value of approximately 0.30$US, implying about 18,000$US in value to farmers. Estimated total value to farmers of the Project's tree planting activities (occurring primarily during the Spring of 1993) is 98,000$US.

HEDGEROWS CASE DESCRIPTIONS AND PHOTOGRAPHS

CASE I

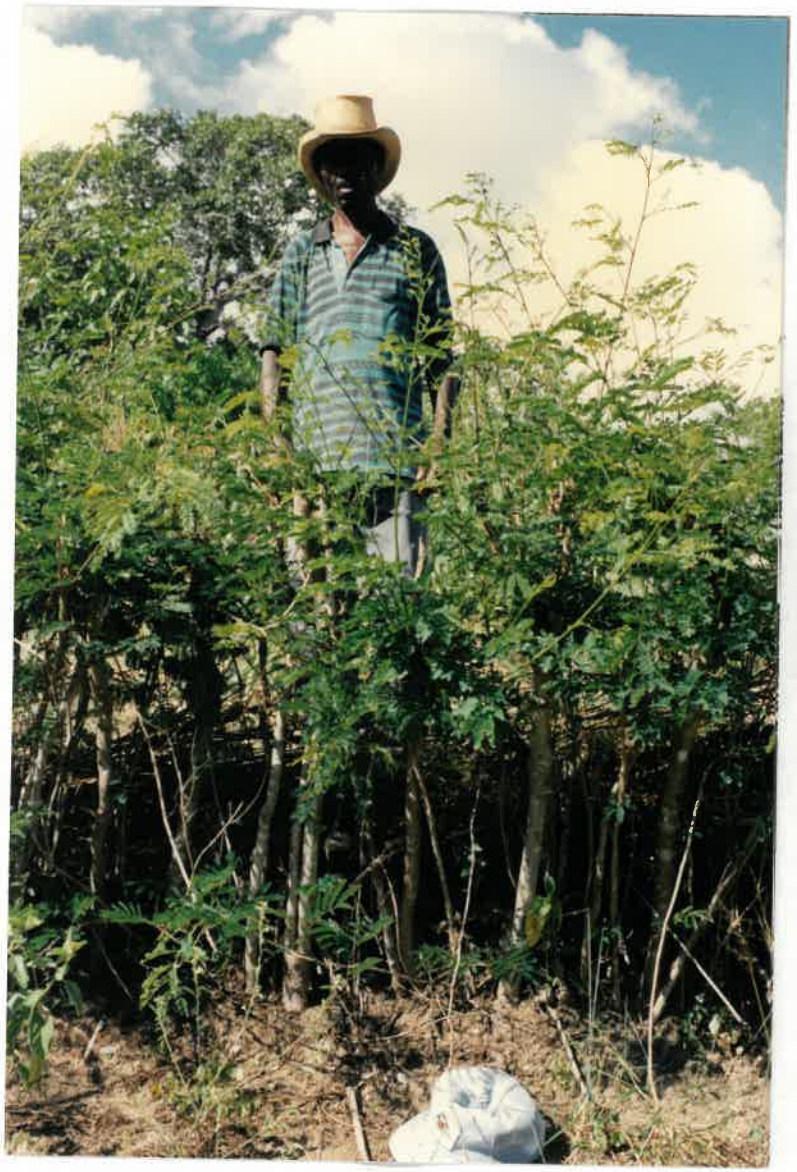
Farmer Vanot Lorilus of Roche Fort near Bombardopolis began installing leucaena hedgerows in 1986. All the land around his home--his vegetable gardens and adjacent field crop plots--is protected with leucaena hedgerows. He told us he felt his harvests have increased over what they would have been as a result of the hedgerows. He feels the hedgerows provide food security by holding the soil in a position that allows him to farm it.

The picture below shows Farmer Vanot Lorilus and SECID/PLUS Agronomist Frank Brockman standing on uphill and downhill sides of one of Vanot Lorilus' 7-year old leucaena hedgerows. The difference in the positions of the two men is indicative of the depth of soil built-up behind the hedgerow. The soil Lorilus is standing on is quite level for a distance of 1 to 2 meters toward the uphill slope. The soil Brockman is standing on has approximately a 30 percent slope.



The picture below shows Farmer Vanot Lorilus and SECID/PLUS Agricultural Economist J. D. (Zach) Lea standing on uphill and downhill sides of another of Vanot Lorilus' hedgerows. The difference in height is indicative of the height of soil behind the hedgerow. The difference in foliage is due to one hedgerow having been recently clipped.

The picture below shows Farmer Vanot Lorilus standing on the uphill side of his hedgerows. Note the cap lying at the base of the hedgerow on the downhill side. This gives an indication of the depth of soil trapped by the hedgerow. Brockman took some physical measurements from the hedgerow and estimated that approximately 25 cubic meters of soil had been trapped by 139 linear meters of these hedgerows. That is the equivalent of about 5 dump truck loads of soil.



The picture below shows Brockman standing at the up-hill margin of the built-up soil behind one of Vanot Lorilus' hedgerows. The change in slope due to the soil build-up is perceptible. Compare the slope to Brockman's right to that on his left.

Case II

Nadal Pièrre, who farms land near Bombardopolis, installed leucaena hedgerows 4 to 5 years ago. Nadal recognizes that the hedgerows capture soil but because of the drought (for the past five years his field crop yields have been almost non-existent) he cannot make a meaningful comparison between yields with and without the hedgerow. A couple of problems Nadal mentioned in connection with the leucaena hedgerow are that animals tend to eat so much of the leaves that he does not have much for soil enhancement purposes. Secondly, the leucaena is very invasive (via self-produced seed) and can take over more of the field than intended unless the farmer is careful to clip the trees before they produce seed. To combat both of these problems, Nadal is testing the use of another tree, the flamboyant, for hedgerow purposes. Animals do not eat it and it appears to be less invasive than leucaena.

The picture below shows SECID/PLUS ag. economist Lea and CARE/PLUS agronomist Gustin Judicael checking Nadal Pièrre's flamboyant hedgerow. Lea is indicating the depth of soil captured by the hedgerow.

The picture below shows SECID/PLUS agricultural economist Lea and CARE/PLUS agronomist Cazeau Condé standing on downhill and uphill sides of a 4 - 5 year old leucaena hedgerow managed by Nadal Pièrre near Bombardopolis.

CASE III

Farmer Pacot Erzilus, who farms about 6.5 carreaux at Bondié Di near Bombardopolis, is a strong supporter of leucaena hedgerows and contour rows of buried organic-material (ramp paille). Following the directions of his CARE/PLUS extension agent, Loreste Moise, Pacot has installed leucaena hedgerows on all his land. Between the hedgerows Pacot uses ramp paille to improve the texture, fertility, and moisture absorption capability of his soil.

As benefits he attributes to the leucaena hedgerow and ramp paille, Pacot listed better yields due to better soil and water conservation (rain water tends to penetrate the soil and be absorbed better, reducing runoff). He noted that potatoes near the hedgerows seem to develop better those planted elsewhere. Pacot told us that he now can support a much larger herd of goats on his fallow land using the fodder provided by the leucaena.

Pacot manages hedgerows on his fallow land differently from those on land currently being cropped. On the fallow land the leucaena were a meter or more tall producing abundant forage but no seed. The leucaena on the cropped land were cut at a height less than 20 cm, providing soil capturing but no shading effects. Brockman made some measurements of the soil trapped behind 190 linear meters of Pacot's leucaena hedgerow and estimated that approximately 9 cubic meters of soil had been trapped.

Pacot Erzilus and CARE/PLUS extension agent Loreste Moise standing in one of Pacot's fields. The difference in position of the two men indicates the amount of soil build-up behind the leucaena hedgerow running between them.

The picture above was taken in the same farm field as the picture on the previous page. The picture provides some indication of the degree of slope of the farm field and the spacing of the leucaena hedgerows.

This picture shows a mixed leucaena/panic grass hedgerow on land near that of Pacot Erzilus. The build-up of soil behind the hedgerow is indicated by the position of SECID/PLUS ag. economist Lea and CARE/PLUS extension agent Loreste Moise. The positions of Moise, his field assistant and Agronomist Cazeau Condé indicate the modified slope of the hillside resulting from the series of hedgerows.

This is a picture of leucaena hedgerows on hillsides near Bondié Di (Bombardopolis). The farms fields of Pacot Erzilus are off the picture to the left.

CASE IV

Farmer Jean Souffrant of Lafond, near Bassin Bleu in the Northwest region of Haiti, is quite pleased with the leucaena hedgerows he installed in April 1990. In discussing the benefits of the hedgerows with SECID agricultural economist Roosevelt Saint-Dic, Souffrant indicated he had experienced a crop yield increase of about 30 percent. He attributed the increased yield to the increased soil moisture associated with the hedgerow. He also recognized the reduction in soil erosion which he attributed to the reduced force of rainwater runoff.

Jean Souffrant is quite concerned about the possibility of the leucaena taking over his field; and so, trims the leucaena twice a year before the trees can produce seed. Souffrant felt that this fear of the leucaena's capability to invade and take over areas via self seeding explains why some farmers in his area have not installed leucaena hedgerows. Saint-Dic noted that most farmers in the area with hedgerows were trimming their hedgerows regularly and placing the trimmed material on the hedgerow as recommended by CARE/PLUS Project personnel. It is interesting to note that Souffrant did not attribute his yield increases to the soil amendment benefits of the leucaena clippings.

CASE V

Farmer Hérode Aimé of Lafond estimates that his crop yields have increased 15 percent as a result of the leucaena and flamboyant hedgerows he installed in 1989. He feels the hedgerows make his field more drought-resistant; so that, even in strong drought years, he has not experienced complete crop failure. Additionally, the leucaena hedgerows have enabled him to obtain forage for his animals during the dry seasons of the year.

CASE VI

Farmer Eugène Assilus of Palmiste Avin/Cormier (near Jacmel) has installed leucaena hedgerows on about 40% of his 1.29 hectare farm plot in December 1991. Prior to installation of hedgerows, Eugène cultivated, manioc, pigeon peas, sorghum, and corn on his plot. With the hedgerows in place, he can now plant two crops of corn and beans. Last year Eugène earned an extra 1,800 gds revenue with the extra bean crop alone. His last manioc crop was 50 percent higher than without the hedgerow. Eugène attributes these increases to the increased soil moisture due to the hedgerow. As for hedgerow maintenance, Eugène trims his hedgerows once a year and denies animals access to the hedgerow. His confidence in the technigue shows through his regular maintenance efforts. He is even planning to install sugar cane, and leucaena hedgerows on land that he has taken on a sharecropping basis. For him, reasons which explain other farmer's hesitancy in adopting hedgerows are: the significant number of non-resident landholders and need for pasture land.

CHECKDAMS CASE DESCRIPTIONS AND PHOTOGRAPHS

CASE VII

Because of the interest created in checkdam by CARE/PLUS extension efforts, Farmer Emile Petit Frère of Passe Catabois near Port de Paix has reclaimed a .5 carreau plot of land that he had been renting. The plot has a large ravine running through it, accordingly, the rent was only 150 gds per year. With the help of the CARE technicians, Frère built about 10 checkdams in the ravine in March 1993. SECID agricultural economist Saint-Dic visited Mr. Frère in October 1993 and found him harvesting cowpeas from the soil accumulated behind the checkdams.

Frère had also planted four coconut trees and 24 plantain trees behind the checkdams. He has plans to plant at least 72 plantain trees as soon as he can obtain the plants. Saint-Dic estimated that if Frère succeeds in selling only 50 percent of his planned crop of plantain, he will receive about 900 gds in revenue. After subtracting cropping expenses and the 150 gds of foregone rent, Saint-Dic expects that Frère can count on approximately 600 gds net benefits from the plantain alone. Understandably, Frère is planning to build more checkdams in other ravines.

CASE VIII

In December 1992, Farmer Fortina paid 2,000 gds for a ravine which contained holes more than 1.5 meters deep. He built six checkdams in the ravine. By October 1993, the checkdams were nearly full of trapped soil and Fortina estimated the value of the ravine at 3,000 gds. Fortina says that checkdams mean money.

The above picture shows a checkdam or gully plug placed across a relatively wide ravine near Bombardopolis. SECID/PLUS agronomist Brockman is standing at the base of the checkdam. CARE Agronomist Gustin Judicael (in stripped shirt) is standing on top of the checkdam. The road runs across the ravine on soil captured by the checkdam. The checkdam consists of leucaena trees and other vegetation. The next three pictures relate to this checkdam.

This picture shows the checkdam from a downhill position. The amount of soil accumulated can be appreciated by noting the difference in the level of the roadbed and the slope of the soil at the base of the checkdam (in shadow).

This photograph was taken from a side of the ravine on the uphill side of the checkdam and illustrates the impact on the sorghum crop of the improved soil and water conditions created by the checkdam. CARE/PLUS agronomist Condé is standing at the edge of the planted plot. The sorghum on his right (toward the checkdam) is well-developed, with growth well above Condé's head. The sorghum on his left is much less well developed--no plants in this area are taller than Condé. The following picture may illustrate better the differences in sorghum development.

This photo shows the same scene as the photo on the previous page, but from a different camera angle.

VEGETABLE GARDENS CASE DESCRIPTIONS

CASE IX

Farmers Georges Suffrin and Fashine Mass of Lafond are the leaders of a group of eleven farmers who have pooled their time and resources to work a 100 square meter vegetable garden since 1990. With the guidance of their CARE/PLUS extension agent, they have produced carrots, beets, spinach, and cabbage for home consumption and for sale. They also produced papaya and pimento pepper seedlings for their home gardens and for sale at 5 gds per dozen. They have not kept records but estimated that sales revenue (not counting the self-consumption) to the group was between 1,000 and 1,500 gds per year. Significantly, the majority of the members have begun their own vegetable gardens.

CASE X

Another group of farmers, lead by Dézimab Désinord, have had a similar experience with their vegetable garden. As a result, they have learned how to produce vegetables, helped feed their families, and earned some extra cash. Some of the extra cash has been put into the traditional, rural Haitian saving account: a goat.

CASE XI

Madam Farmer Anicette Désinord is our most impressive farmer. She not only has made enough money, during a 7 month period, from her 130 square meter vegetable garden to buy two goats, she has actually kept records of her gardening expenses and revenues over the 7 month period. She says the garden permits her to make more money than she could with traditional crops; but, perhaps more important, she can earn the money on a weekly basis. According to Madam Désinord, her garden allows her to sales and expenses are as follows:

SELECTED REVENUE AND EXPENSE DETAILS

FROM FARMER ANICETTE DESINORD

Expenses

- Seeds:	22.50 Gdes
- Insecticides:	5.00 "
- Soils preparation:	34.00 "
- Plantation:	16.00 "
- Watering:	88.00 "
Total:	165.50 Gdes

Sales

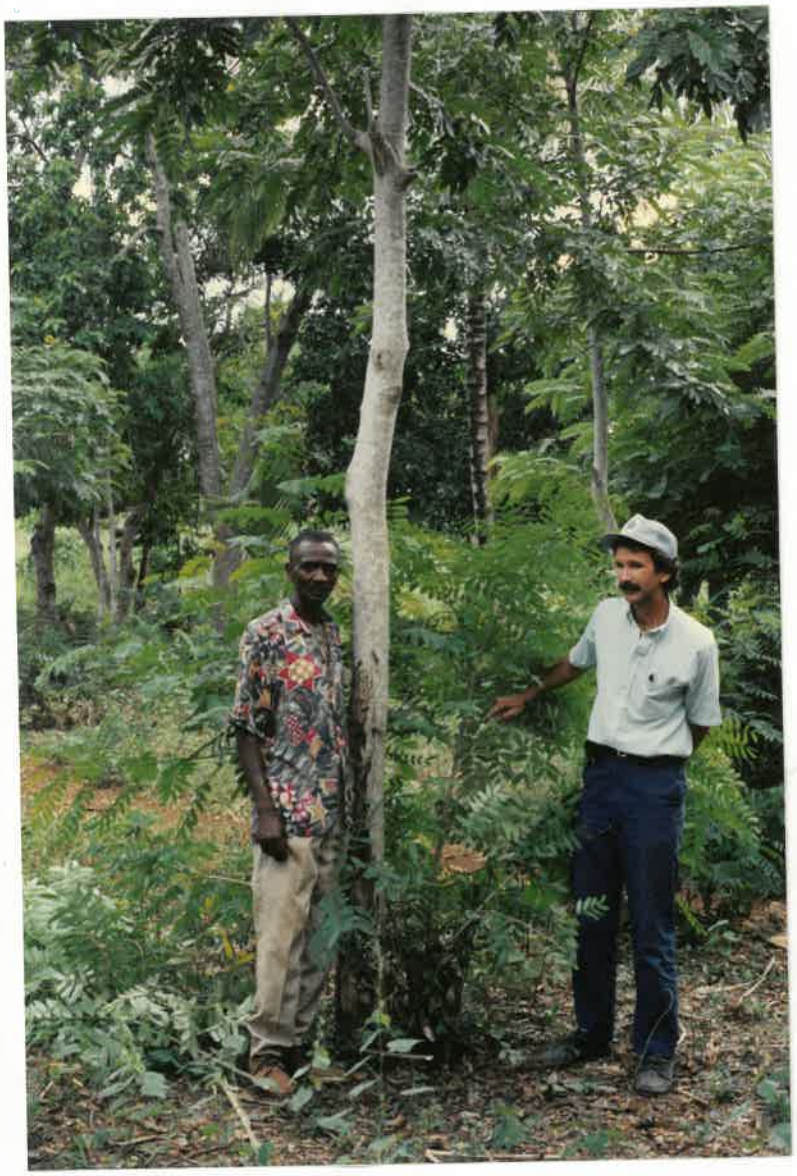
- Cabbage:	256.00 Gdes
- Spinach:	194.00 "
- Lima beans:	150.00 "
- Beetroot:	122.00 "
- Carrot:	120.00 "
- Pimento:	96.00 "
- Okra:	80.00 "
- Tomato:	53.00 "
Total:	1.071.00 Gdes

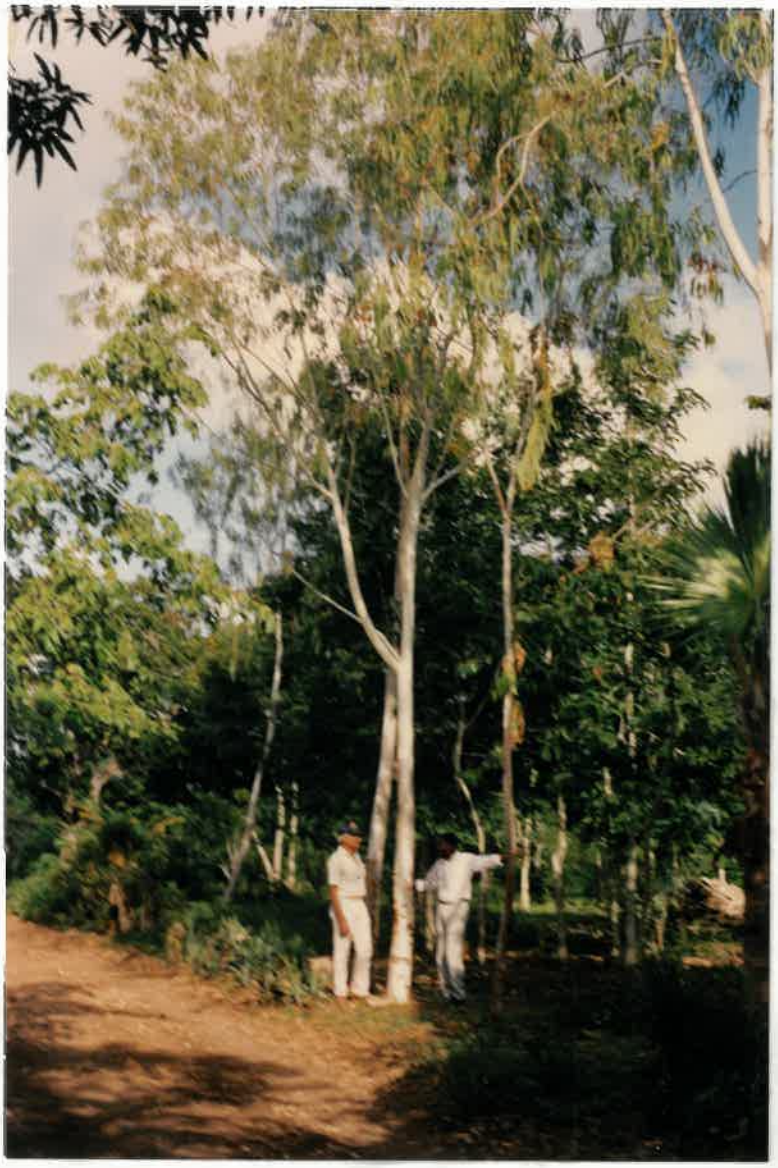
Net Benefit 905.50 Gdes

TREE CASE DESCRIPTIONS AND PHOTOGRAPHS

The following pictures of trees were taken in early October 1993 to illustrate some of the situations in which trees distributed by the predecessor projects to PLUS are now found.

This picture shows Farmer Straibert Desliens and J. D. Lea with a regrowing Cassia siamea on Desliens' farm near Bombardopolis. Desliens told us he was an active participant in CARE's tree planting programs and had sold 60 Haitian dollars worth of trees from his land last year.





This picture shows some eucalyptus and cassia trees on a small plantation near Bombardopolis.

Some leucaena trees planted near homes in Bombardopolis area.

This picture is of some Gliricida sepium trees in the center of the photograph, a Catalpa longissima individual on the left and an eucalyptus species on the right. Note that the eucalyptus is a regrowth stem.

This picture shows several tree species planted near a home near Bombardopolis.

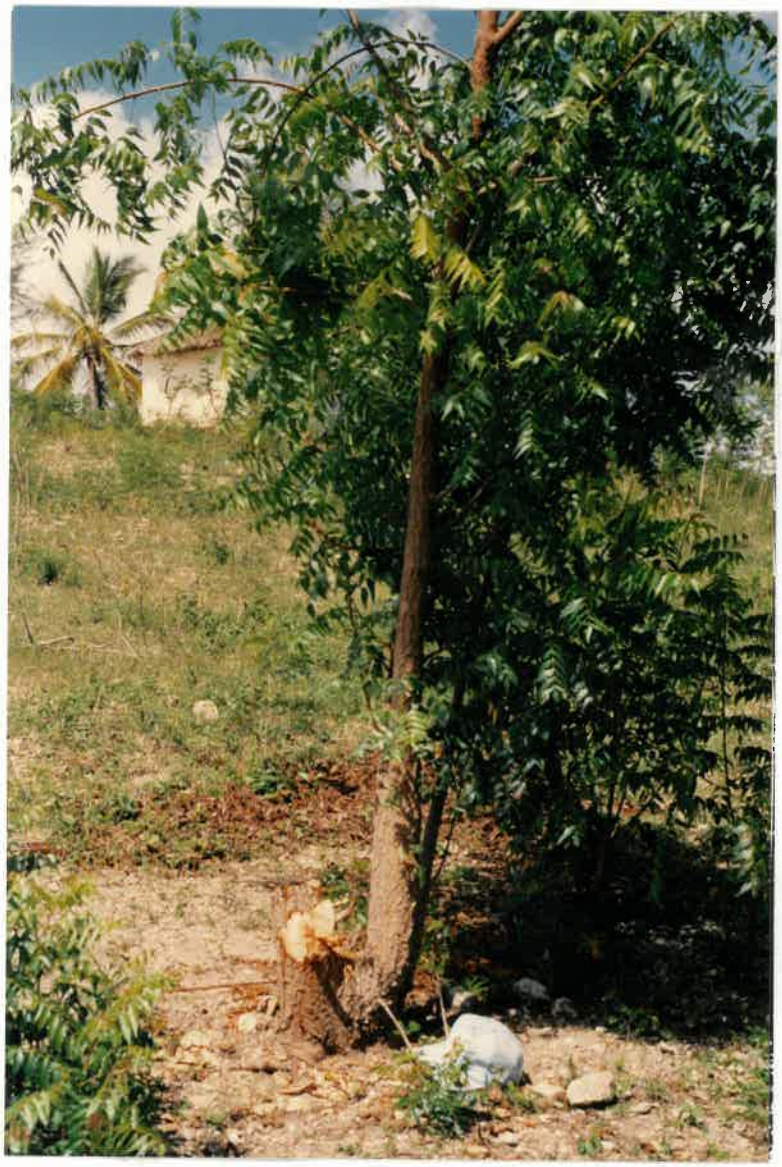
The following 3 pictures are scenes of a leucaena hedgerow that has been managed for wood or pole production. The picture below shows the resulting plantation in an area of abandoned farmland.

This picture shows the land between the over-grown hedgerows.

This picture indicates the amount of soil buildup behind the overgrown hedgerow via difference in position of the two persons in the photograph.

This picture shows a field with leucaena hedgerows adjacent to the plot shown in the previous three pictures. We do not know the management regime used on the plot; however, we surmised from the shape taken by the trees that browsing animals had held the plants at the low height seen. Note that closely cropped hedgerow has trapped 5 - 10 cm of soil in places where the number of plants were sufficient to form a barrier.

In several places near Bombardopolis we saw similar farm plots with the same thin hedgerows of leucaena and the same rocky, worn-out looking soil. In most places, however; there was less vegetative cover than seen in the above picture. In most cases, the closely-cropped leucaena were the major plants visible. One hypothesis we formed was that the hedgerows must have been placed on farm plots that were too exhausted to support regular field crops and had been returned to long-term fallow with its associated, open-range grazing management scheme.



This picture shows a neem tree which has been harvested at least twice and has produced a third stem. The primary stump of this tree is about 15-20 cm in diameter.

This is picture of a second, resprouting neem tree. The primary stump of this tree is also about 15-20 cm in diameter. Lea has placed his hand on the stump to indicate its size. Agronomist Brockman observed that thinning the sprouting regrowth stems back to one or two stems might result in faster production of a large-diameter stem.

AN UNPICTURED CASE DISCRIPTION OF TREE-FARMING SUCCESS

Farmer Cénor Saint-Vital, whose farm is near Jacmel, had a plot of about 650 square meters which was, according to him, a true desert; the plot was very exposed to wind, and all crops were badly moisture stressed. To improve this land, Cénor began in 1985 to plant fruit trees; unfortunately most of the fruit trees did not survive. After this failure, he replanted the plot with forest trees which have survived. Now Cénor has about 50 forest trees (cassia, leucaena, neem, eucalyptus), 10 fruit trees (mango, citrus, coconut-tree), and 25 plantain trees which have begun to produce. He has already has cut four trees which sold for 300 gdes and has trees ready for cutting worth more than 1.000.00 gdes. He now has a tree nursery near his home with 100 bread fruit trees, and 100 avocado trees. 35 of theses plants will be planted in his own fields. The rest will given to friends or sold. Additionally, Cénor has recently been able to cultivate successfully pigeon peas, manioc, and cowpeas on his once-inhospitable plot.

APPENDIX A

DERIVATION OF SELECTED FIGURES USED IN THIS REPORT

Since I, J. D. Zach Lea, am responsible for these derivations, I will use the personal pronoun in explaining them.

HEDGEROWS

I used figures from a previous study of the financial aspects of leucaena hedgerows (Lea) for gross revenue (revenue minus labor expenses). I calculated an average gross revenue for traditional and for hedgerow-protected cases over a ten year period. For the traditional case, I added revenue in years 9 and 10 under the assumption that the land would be returned to productivity after four years of fallow:

1	334.6
2	237.6
3	144.9
4	50.7
5	0
6	0
7	0
8	0
9	334.6
10	227.6
Total	1,330.0

The yearly average gross revenue for the traditional case is 133$H. The average for the hedgerow protected land is 260$H per hectare. Subtracting these two averages gives the improvement in gross revenue attributable to the hedgerow technology, namely, 127$H or about 52$US. This flow should continue as long as the land is farmed in the same way. Thus, deciding what is the present value of this flow of improved gross revenue revolves on our judgement as to the length time the land will be farmed in the same way and the discount rate to be applied. The figures in Table 1 demonstrate the possibilities using a ten percent discount rate. At 10 years, the present value (at a ten percent discount rate) of 52$US per year is about 350$US. At 15 years, it is about 435$US. I chose to use the 15-year figure.

To get the figures used in the text, assume that 2km of hedgerow protects 1 hectare of land. Thus, we have 100 hectares of land protected. Assume that only 60 percent of these farms achieve full results. Thus, (100 hectares)(.6)(435$US) = 26,100$US.

The available figures indicate there are about 8 farmers per hectare (800 farmers/100 ha). Thus, the present value of the stream of increased income is worth about 54$US to each farmer (435/8 = 54.37).

CHECKDAMS

Since the PLUS Project has not yet collected revenue and expense data from checkdam crops, I have used existing data from Manuel d'agronomie tropicale appliquée à l'agriculture haïtienne relating to monocultured plantain (Pillot et al., page 141). Pillot et al. indicate that the annual return to land, labor, and management (revenue minus input expenses other than management and land) per hectare of plantain is about 4,200$H. I have used 4,000$H as an estimate. Assuming this sum will be received annually over a 15 year period implies a stream of income with a discounted (at 10 percent) present value of about 15,000$US.

VEGETABLE GARDENS

As shown on page 27, the net revenue earned by farmer Anicette Desinord from her 130 square meter garden was about 900 gourds over a 7 month period. This is equivalent to 5650$US per hectare. To be conservative, I have used 4,000 to 5,000$US as an estimate of the annual revenue to a typical garden.

$$900gds/130m^2 = 6.9gds/12.25gds/\$US = \$US.565/m^2$$

TREES

Tree seedlings that will be used for poles have a present value to the farmer (assuming a 40 percent survival rate) of 0.30$US. Fruit trees such as mango have a present value to farmers of about 20$US (assuming a 100 percent survival rate). Since not all fruit trees are high value mango trees, I use 10$US as the value per tree for these preliminary estimates.

I calculate the value of a mango tree as the discounted net present value of the flow of income from sales of fruit. I assumed the tree seedling was free, having been produced in a home nursery or group nursery. After four years of growth, I assume the tree will produce 240 mangos per year for 20 or more years. I assume the mangos sell for 3gds per dozen and assume a production cost of 1gds per dozen, leaving 2gds per dozen or 3.26$US per tree per year net profit (return to management and land). Table 2 shows the calculations at a 10 percent discount rate.

$$\$US3.26 = (240 \text{ mangos per tree}/12)(3-1=2gds)/12.25gds/dollar$$

TABLE 1

ESTIMATED PRESENT VALUE OF THE INCREASED INCOME FLOW RESULTING FROM UTILIZATION OF HEDGEROWS

Years	Value of Yearly Income Flow	Discount Factor at 10%	Present Value of Yearly Flow	Cumulative Value of Yearly Flows
1	52	1	52	52
2	52	0.909	47.273	99.273
3	52	0.826	42.975	142.248
4	52	0.751	39.068	181.316
5	52	0.683	35.517	216.833
6	52	0.621	32.288	249.121
7	52	0.564	29.353	278.474
8	52	0.513	26.684	305.158
9	52	0.467	24.258	329.416
10	52	0.424	22.053	351.469
11	52	0.386	20.048	371.517
12	52	0.350	18.226	389.743
13	52	0.319	16.569	406.312
14	52	0.290	15.063	421.375
15	52	0.263	13.693	435.068
16	52	0.239	12.448	447.516
17	52	0.218	11.317	458.833
18	52	0.198	10.288	469.121
19	52	0.180	9.353	478.473
20	52	0.164	8.502	486.976

TABLE 2

PRESENT VALUE OF A MANGO TREE

Years	Value of Yearly Income Flow	Discount Factor at 10%	Present Value of Yearly Flow	Cumulative Value of Yearly Flows
1	0	1	0	0
2	0	0.909	0.000	0.000
3	0	0.826	0.000	0.000
4	0	0.751	0.000	0.000
5	3.26	0.683	2.227	2.227
6	3.26	0.621	2.024	4.251
7	3.26	0.564	1.840	6.091
8	3.26	0.513	1.673	7.764
9	3.26	0.467	1.521	9.285
10	3.26	0.424	1.383	10.667
11	3.26	0.386	1.257	11.924
12	3.26	0.350	1.143	13.067
13	3.26	0.319	1.039	14.105
14	3.26	0.290	0.944	15.050
15	3.26	0.263	0.858	15.908
16	3.26	0.239	0.780	16.689
17	3.26	0.218	0.709	17.398
18	3.26	0.198	0.645	18.043
19	3.26	0.180	0.586	18.629
20	3.26	0.164	0.533	19.163

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